1. Matrix multiplication is not commutative. That is, in general, the product $AB$ is not the same as the product $BA$. Verify this by multiplying the matrices

$$A = \begin{pmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \quad \text{and} \quad B = \begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{pmatrix}$$

both ways. Are the results different?

2. However, in special cases, matrices may commute. For example, let

$$A = \begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{pmatrix} \quad \text{and} \quad B = \begin{pmatrix} 1 & 0 & 4 \\ 0 & 1 & 5 \\ 0 & 0 & 1 \end{pmatrix}.$$ 

Verify that $AB = BA$.

3. Use the program Lecture 8 Demo 1.cpp in this and the following exercises. In the display() function, move the call to glTranslatef() to a position just beyond the call to glScalef(). Run the program. Is there a difference? Can you explain it?

4. Now move the call to glRotatef() to a position just beyond the call to glTranslatef() and run the program. Is there a difference? Can you explain it?

5. Now move the call to glScalef() to a position just beyond the call to glRotatef() and run the program. Is there a difference? Can you explain it?

6. Remove the geometric transformations that are in display() and replace them with the following. Beginning at the origin, translate to $(2, 0, 0)$ and draw a shiny red sphere. Then translate from there to $(-2, 0, 0)$ and draw a shiny green sphere. Then translate from there to $(0, 0, -2)$ and draw a shiny blue sphere.

7. Use a for loop to create a series of eleven shiny red spheres of radius 0.5, located at $(-5, 0, 0), (-4, 0, 0), \ldots, (5, 0, 0)$. The body of the for loop should contain a call to glTranslatef() and a call to glutSolidSphere().

8. In the display() function, comment out the call to glLoadIdentity() and run the program. What happens? Why? Now uncomment the function call.